

BROAD AGENCY ANNOUNCEMENT FOR CONTRACTS, GRANTS,
COOPERATIVE AGREEMENTS, AND OTHER TRANSACTIONS DAAD19-00-R-0010
AMENDMENT 0003

1. The purpose of this amendment is to update Technical Point of Contact information, and to revise research area 10: Computational and Information Sciences

2. Revise Research Area 10: Computational and Information Sciences as follows:

RESEARCH AREA 10

COMPUTATIONAL AND INFORMATION SCIENCES

10.1. Military Extensible Markup Language (milXML). Extensible markup language (XML), a subset of standard generalized markup language (SGML), was approved by the World Wide Web Consortium in 1998, with the hope that XML would offer a more efficient way to publish Web pages. Gradually, developers found out that the power of defining their own tags separate from the file contents meant that data could be defined and easily exchanged. Web publishing is now spreading to more data interchange situations. Now XML is taking on e-commerce.

Commerce XML (cXML) initiative is launched with the goal of fitting the document schema into the data-flow environment.

The electronic business XML (ebXML Initiative™) creates a single global XML framework solution. The ebXML is hoped to revolutionize how business transactions are tracked, affecting worldwide impacts, removing paper from the process and by empowering people to create whole new work models.

Financial products markup language (FpML) is a new protocol to enable e-commerce activities in the field of financial derivatives. The synchronous markup language (SyncML), which leverages XML, is the common language for synchronizing all devices and applications over any network. With SyncML, networked information can be synchronized with any mobile device and mobile information can be synchronized with any networked application.

These developments will prompt one to conceive a military XML (milXML) that will assist military strategic and tactical transactions. The ARL would like to receive research proposals to explore the possibility of defining and developing a milXML protocol that is consistent with security and bandwidth issues in CONUS, joint, and coalition operations.

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10.2. Information Science and Technology. The ARL is interested in basic and applied research resulting in technologies that support state-of-the-art capabilities for the warfighter in the analysis, assimilation, and dissemination of real and simulated digitized battlespace information. Areas of interest include, but not limited to:

- a. Intelligent software agents.
- b. Course of action analysis and comparison.
- c. Software reuse.
- d. Embedded training on the use of the system.
- e. Automated distribution of operational orders.
- f. Collaborative technologies for distributed work environments.
- g. Information and data fusion/visualization.
- h. Data mining
- i. Machine translation of text and speech data.
- j. Mixed small robot/soldier team collaboration and behavior.

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10.3. Wireless Information Assurance and Survivable Communications. The ARL is interested in receiving proposals that address the underlying science and technology survivable and secure communications over wireless networks, information infrastructure protection, and survivable systems engineering. The objectives of the research are to provide secure, survivable, and assured communications over wireless networks, including highly mobile networks. Research interests include, but should not be limited to, advancing the state of the art in the following areas:

- a. Research on automated vulnerability assessment and intrusion detection tools and techniques.
- b. Genetic algorithms used to spawn and control intelligent agents for information assurance.
- c. Information hiding in images and text (steganography and watermarking).
- d. Key distribution and security in a mobile wireless ad hoc network.
- e. Tools and techniques for automating the creation and distribution of interoperable vulnerability knowledge bases.
- f. Tools and techniques for automated analysis and correlation of anomalies, probes, and detections from multiple sites and to support post-incident forensic analysis.
- g. Network management and visualization tools that support real time planning and control of tactical nets as well as tools for intrusion detection and forensic analysis in hybrid networks.

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10.4. Sensor Network Communications. ARL is developing communications devices and technologies for unattended sensors. These unattended devices must work for long periods

on limited battery power, use Anti-Jam and Low Probability of Detection waveforms, perform ad-hoc networking for autonomous self-healing routing, and provide network security for authentication, data integrity and privacy. Areas of interest include, but not limited to:

- a. ad-hoc network protocols
- b. security protocols
- c. robust AJ/LPD waveforms
- d. energy efficient modems
- e. energy efficient RF front-ends
- f. low power signal processing
- g. small broadband antenna
- h. forward-error-correction

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10.5. Wireless Mobile Communications. The ARL is interested in receiving proposals that address the underlying science and technology for mobile wireless communications networks, especially the mobile tactical domain, and including sensor networks. The objectives of this research are to enable Army multimedia communications among highly mobile users, sensors, and robotic platforms under adverse channel conditions, with desired quality of service on demand. Research areas of interest include, but are not limited to, advancing the state of the art in the following areas:

- a. Bandwidth and energy constrained mobile transceiver design.
- b. Cross-layer designs, especially with respect to physical layer and media access layer interaction.
- c. Multi-antenna methods, including space-time processing, for mitigating multiuser and intentional interference, while achieving very high capacity.
- d. Techniques for overcoming electronic warfare and jamming threats.
- e. Frequency agile systems.
- f. The combination of channel equalization and coding techniques.
- g. Wideband modulation methods such as orthogonal frequency division multiplexing.
- h. Ultra wideband systems, including coexistence issues and system overlays.
- i. Sensor networking systems, including signal processing and communications interactions, distributed detection and estimation, and networking protocols.
- j. Ad hoc mobile networking protocols and procedures.

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10.6. Atmospheric Effects Modeling and Simulation. The ARL is interested in receiving proposals that address the technology and technical barriers for improving the state of the art of critical scientific areas that affect atmospheric modeling and simulation. The objectives of the research are to mitigate the effects of weather and battle-induced atmospheres on combat materiel, personnel, and doctrine; to optimize the performance of friendly forces under

realistic battlefield conditions; and to enhance the use of smoke, camouflage, concealment, deception, and low-observable technology. Research interests include, but should not be limited to, advancing the state of the art in the following areas:

- a. Research on and models of the propagation of acoustic energy in the atmospheric environment under neutral and battlefield conditions.
- b. Atmospheric effects decision aids for acoustic systems.
- c. Sound detection and ranging techniques.
- d. Computer, artificial intelligence, display, and man-machine interface techniques in weather intelligence concepts.
- e. Unified weather packages of atmospheric effects decision aids for potential use in automated systems of the different battlefield functional mission areas.
- f. Atmospheric effects decision aids consolidating the effects of realistic battlefield conditions and operations, systems, and sub-systems.
- g. Models of electromagnetic propagation through the atmosphere at UV through millimeter-wave lengths under natural and battlefield conditions for mitigating atmospheric effects on Army systems.
- h. Research on and models of atmospheric effects on images and scenes under natural and battle-induced conditions.
- i. Obscuration models for battlefield conditions, including weather, natural and battle-induced smokes, and dust.
- j. Atmospheric effects decision aids for the use of smoke, camouflage, decoys, and low observables.
- k. Incorporation of the effects of weather, clutter, and battlefield obscurants into target acquisition.
- l. Atmospheric effects decision aids for mitigating the effects of natural and battle-induced atmospheres on target acquisition.
- m. Simulation of battlefield environmental effects for distributed simulation and high-level architecture.
- n. Advanced numeric modeling techniques that use state-of-the-art computer technology, such as parallel processing.

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10.7. Database Technology. Explore ideas and prototype tools for advanced data management concepts, including schema integration and data warehousing in a standardized data environment, enable transparent access to multiple heterogeneous databases, data mining and knowledge discovery in large distributed databases, automated query formulation strategies using data element thesaurus capabilities, integration of data encyclopedia tools with data and process modeling tools, and automated support for electronic records management and digital signature. Implement and experiment with simultaneously and transparently accessing and manipulating data from any different databases, to include support for imaging, multimedia, object-oriented, and traditional applications. Investigate new ideas, and design, implement, and evaluate prototype data management tools which

support the Army Information Architecture, Army modernization efforts, and the Army's Future Combat System (FCS).

Technical Point of Contact: Ms. Pat Jones, email: pjones@arl.army.mil, 410-278-5840

10.8. Software Engineering. In an open systems environment, develop concepts for prototype components of software engineering technologies which reduce software life-cycle costs, increase modularity and interoperability, increase productivity of software design/development and support organizations, and improve the quality, reliability and reusability of delivered components, systems, and products. Explore methodologies and technologies (e.g., object-oriented), which achieve substantial improvement and cost reduction in software development, requirements analysis and definition, software management, complexity, and quality metrics, reuse, re-engineering, maintenance. This includes tools and techniques (e.g., intelligent agents, wrappers) to aid in migrating or interfacing legacy systems to Java-based or other state-of-the-art systems. Topic includes any software engineering technologies, which aid in the Army's efforts to digitize the battlefield and its tactical command and control systems.

Technical Point of Contact: Ms. Pat Jones, email: pjones@arl.army.mil, 410-278-5840

10.9. Technology for Course of Action (COA) Analysis. The ARL is interested in basic and applied research resulting in technologies that support state-of-the-art capabilities for the warfighter in the analysis, assimilation and dissemination of real and simulated digitized battlespace information. The Computational and Information Sciences Directorate is leading the ARL's Digitization and Communications Science thrust. One aspect of the effort is the development of methods for providing data for warfare (and operations other than war) to the commander's planning staff in a manner that can be readily used. The ARL is soliciting proposals for technology to provide automated tools for the future force that support planning, commander-staff-subordinate collaboration, dissemination of mission intent, mission monitoring, and adaptation.

In particular, current COA analysis methods may lack the sophistication and speed required to guarantee that understandable information is provided in a timely manner to intended recipients. The ARL seeks approaches to analysis of COAs that address the domain of the Army command and control systems vis-à-vis tactical operations centers and that can be extended across the spectrum of operations to be encountered by the future Army. Areas of interest include: techniques for automation augmented planning and decision-making; analytical tools to increase decision cycle speed; approaches to integration of the results of multiple war games and simulations for consideration of many COAs in near real time; COA analysis approaches accounting for incomplete data; identification of data structures required for battlefield analysis of COAs produced in the near-term C2 infrastructure; approaches to evaluation of COA systems (e.g., with regard to utility and quality); interface with standardization efforts involving C2 message elements; systems to check COAs against standards (e.g., the principles of war, historical "sanity") or criteria (e.g., the commander's intent, supportability); statistical techniques (e.g., nonparametric hypothesis

testing) for COA comparison; operations research methods for COA evaluation (e.g., multi-attribute utility analysis).

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10.10. Battlefield Environmental Research. The ARL is interested in basic and applied research resulting in technologies that support state-of-the-art capabilities for the warfighter in the measurement, analysis, assimilation, and dissemination of real and simulated digitized battlespace weather and atmospheric information. Areas of interest include, but are not limited to:

- a. Microscale atmospheric boundary layer meteorology, at resolutions below 1 km that consider urban and vegetative canopy effects.
- b. Diagnostic tools for determination of realistic spatial variability of atmospheric parameters in limited but complex domains.
- c. Electromagnetic and acoustic propagation, especially electro-optical EM propagation, and infrasonic acoustic propagation.
- d. Atmospheric aerosol properties and behavior, including mineral, biological and liquid components.
- e. Efficient distributed weather forecasting technology for hosting on future Army tactical computer platforms.
- f. Methodology and applications for the use of satellite remote sensing of environmental conditions.
- g. Environmental decision support technology (tactical decision aids) for transforming weather information into mission planning and battle decision intelligence.
- h. Physically accurate weather visualization tools.

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10.11. Scalable Computational Sciences. Research and development proposals are required in the areas of multi-disciplinary computational approaches on high performance computers to address challenges in simulating practical Army applications. Specific areas of interest include: (i) innovative and scalable methodologies (including finite element methods, particle methods, etc.) for computational mechanics Computational Fluid Dynamics (CFD), Computational Structural Mechanics (CSM), Computational Electromagnetics and Acoustics (CEA), and Computational Chemistry and Materials (CCM), etc.); (ii) innovative space and time discretization numerical algorithms including scalable equation solvers for a wide class of nonlinear computational mechanics problems; (iii) computational methods for interdisciplinary applications (example: structure-medium interaction, Eulerian-Lagrangian, etc.); (iv) multi-scale computational approaches (example: Macro-meso-micro approaches, molecular dynamics-continuum mechanics coupled approaches, etc.); (v) computational methods to address innovative structures for Army applications (designing, manufacturing, testing, verification and validation); and (vi) data mining for scientific applications.

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10.12. Knowledge Management and Business Intelligence Systems. Integrated enterprise systems that include web-based portals of entry, enterprise data repositories, integrated data environments, advanced data and text search engines, integrated enterprise ERP applications, and advanced data discovery software for the analysis and display of context-rich information is critical for knowledge management and business intelligence. Interest includes knowledge fusion of heterogeneous data and multimedia types, data mining, text mining, knowledge agents, knowledge brokers, knowledge visualization systems, federated knowledge warehouses, and knowledge standards.

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10.13. Information Technology. ARL is interested in proposals that focus on new, innovative uses of Internet web technologies and Lotus Domino/Notes as a primary user interface into a wide variety of enterprise-wide business applications that use Army Standard Systems. In particular, the research should focus on methods and tools that improve developers' abilities to provide new applications across varied user platforms and operating systems while dealing with legacy systems and legacy systems data. ARL is interested in proposals that focus on technologies that can be applied to life-cycle management of heterogeneous electronic records to enable compliance with directives and regulations such as the Modern Army Records Keeping System (MARKS) and National Archives and Records Administration (NARA) requirements.

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